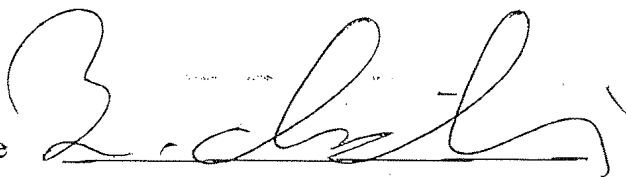


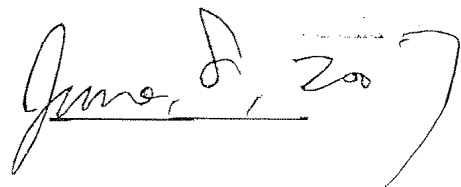
VERIFICATION OF A TRANSLATION

I, Tetsuo AKIYOSHI, of 5th Floor, Shintoshicenter Bldg., 24-1, Tsurumaki 1-chome, Tama-shi, Tokyo 206-0034 Japan, declare that I am well acquainted with both the Japanese and English languages, and that the attached is an accurate translation, to the best of my knowledge and ability, of the Japanese language Patent Application No. JP 2003-284512 filed on July 31, 2003.

Signature



Date



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2003-284512

1

[NAME OF DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION]

RADIO TRANSMITTING APPARATUS, RADIO RECEIVING APPARATUS,  
RADIO COMMUNICATION SYSTEM, RADIO TRANSMISSION METHOD,  
5 AND RADIO RECEPTION METHOD

[SCOPE OF CLAIMS FOR PATENT]

[Claim 1] A radio transmission apparatus that  
measures channel quality between the radio transmission  
apparatus and a communicating party and transmits to the  
10 communicating party a CQI (Channel Quality Indicator)  
that represents a measurement value, comprising:

a memory that stores CQI update cycle information  
representing an update cycle of the CQI and CQI  
repetition count information representing how many  
15 consecutive times the same CQI is transmitted; and

a CQI transmitter that, when a transmission timing  
of a CQI that is based on the CQI update cycle information  
and a transmission timing of a CQI that is based on the  
CQI repetition count information overlap, transmits the  
20 CQI based on the repetition count information to the  
communicating party with priority.

[Claim 2] The radio transmission apparatus  
according to claim 1,

wherein, when the transmission timing of the CQI  
25 based on the CQI update cycle information and the  
transmission timing of the CQI based on the CQI  
repetition count information overlap, the radio

2003-284512

2

transmission apparatus reports to a higher apparatus that the CQI update cycle information and CQI repetition count information in use have an error, receives reconfigured CQI update cycle information and CQI repetition count information from the higher apparatus and stores these information in the memory; and

wherein the CQI transmitter receives the reconfigured CQI update cycle information and CQI repetition count information and thereafter transmits the CQI to the communicating party based on the reconfigured CQI update cycle information and CQI repetition count information.

[Clam 3] The radio transmission apparatus according to claim 1,

wherein, when the transmission timing of the CQI based on the CQI update cycle information and the transmission timing of the CQI based on the CQI repetition count information overlap, the radio transmission apparatus reports to the communicating party that the CQI update cycle information and CQI repetition count information in use have an error, receives reconfigured CQI update cycle information and CQI repetition count information from the communicating party and stores these information in the memory; and

wherein the CQI transmitter receives the reconfigured CQI update cycle information and CQI repetition count information and thereafter

2003-284512

3

transmits the CQI to the communicating party based on the reconfigured CQI update cycle information and CQI repetition count information.

[Claim 4] The radio transmission apparatus of  
5 claim 1,

wherein, when the transmission timing of the CQI based on the CQI update cycle information and the transmission timing of the CQI based on the CQI repetition count information overlap, the radio  
10 transmission apparatus reconfigures the CQI update cycle information and CQI repetition count information anew such that the transmission timings do not overlap, stores the reconfigured CQI update cycle information and CQI repetition count information in the memory, and reports  
15 the reconfigured information to the communicating party;  
and

wherein the CQI transmitter receives the reconfigured CQI update cycle information and CQI repetition count information and thereafter transmits  
20 the CQI to the communicating party based on the reconfigured CQI update cycle information and CQI repetition count information.

[Claim 5] The radio transmission apparatus according to any one of claims 2 to 4, wherein, of the  
25 CQI update cycle information and the CQI repetition count information, the CQI update cycle information alone is reconfigured.

2003-284512

4

[Claim 6] A radio reception apparatus that receives a CQI (Channel Quality Indicator) representing channel quality between the radio reception apparatus and a communicating party and decodes the CQI,  
5 comprising:

a memory that stores CQI update cycle information representing an update cycle of the CQI and CQI repetition count information representing how many consecutive times the same CQI is transmitted and  
10 decoded; and

a CQI receiver and decoder that, when a reception timing of a CQI that is based on the CQI update cycle information and a transmission timing of a CQI that is based on the CQI repetition count information overlap,  
15 receives and decodes the CQI based on the CQI repetition count information with priority.

[Claim 7] The radio reception apparatus according to claim 6,

wherein, when the reception timing of the CQI based  
20 on the CQI update cycle information and the reception timing of the CQI based on the CQI repetition count information overlap, the radio reception apparatus reports to a higher apparatus that the CQI update cycle information and CQI repetition count information in use  
25 have an error, receives reconfigured CQI update cycle information and CQI repetition count information from the higher apparatus and stores these information in the

2003-284512

5

memory; and

wherein the CQI receiver and decoder receives the reconfigured CQI update cycle information and CQI repetition count information and thereafter receives and  
5 decodes the CQI based on the reconfigured CQI update cycle information and CQI repetition count information.

[Claim 8] The radio reception apparatus according to claim 6,

wherein, when the reception timing of the CQI based  
10 on the CQI update cycle information and the reception timing of the CQI based on the CQI repetition count information overlap, the radio reception apparatus reconfigures the CQI update cycle information and CQI repetition count information anew such that the  
15 reception timings do not overlap, stores the reconfigured CQI update cycle information and CQI repetition count information in the memory, and reports these new information to the communicating party; and

wherein the CQI receiver and decoder receives and  
20 decodes the CQI based on the reconfigured CQI update cycle information and CQI repetition count information after the CQI update cycle information and CQI repetition count information are reconfigured.

[Claim 9] The radio reception apparatus according  
25 to claim 7 or 8, wherein, of the CQI update cycle information and the CQI repetition count information, the CQI update cycle information alone is reconfigured.

2003-284512

6

[Claim 10] A communication terminal apparatus comprising the radio transmission apparatus according to any one of claims 1 to 5.

5 [Claim 11] A radio base station comprising the radio reception apparatus according to any one of claims 6 to 9.

[Claim 12] A radio communication system comprising a communication terminal apparatus that transmits a CQI based on predetermined CQI update cycle  
10 information and CQI repetition count information, and a radio base station apparatus that receives and decodes the CQI based on the predetermined CQI update cycle information and CQI repetition count information,

wherein the communication terminal apparatus  
15 transmits the CQI that is based on the CQI repetition count information with priority and the radio base station apparatus receives and decodes the CQI based on the CQI repetition count information with priority.

[Claim 13] The radio communication system  
20 according to claim 12, further comprising a higher apparatus that controls a plurality of radio base station apparatuses,

wherein, when a transmission timing of a CQI that is based on the CQI update cycle information and a  
25 transmission timing of a CQI that is based on the CQI repetition count information overlap, or when a reception timing of the CQI based on the CQI update cycle



2003-284512

7

information and a reception timing of the CQI based on the CQI repetition count information overlap, the upper apparatus receives information indicating the overlap from the communication terminal apparatus or the radio base station apparatus and reports new reconfigured CQI update cycle information and CQI repetition count information to both the communication terminal apparatus and the radio base station apparatus.

[Claim 14] A radio transmission method that measures channel quality between a radio transmission apparatus and a communicating party and transmits to the communicating party a CQI (Channel Quality Indicator) that represents a measurement value, whereby, when a transmission timing of a CQI that is based on predetermined CQI update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, the CQI based on the CQI repetition count information is transmitted with priority.

[Claim 15] A radio reception method that receives, from a communicating party, a CQI (Channel Quality Indicator) representing channel quality between a radio reception apparatus and the communicating party and decodes the CQI, whereby, when a reception timing of a CQI that is based on predetermined CQI update cycle information and a reception timing of a CQI that is based on CQI repetition count information overlap, the CQI

2003-284512

8

based on the CQI repetition count information is received and decoded with priority.

[DETAILED DESCRIPTION OF THE INVENTION]

[Technical Field of the Invention]

5 [0001]

The present invention relates to a radio transmission apparatus, radio receiving apparatus, radio communication system, radio transmission method, and radio reception method, and more particularly can  
10 be applied to radio communication systems where transmission rate is adaptively controlled using the CQI (Channel Quality Indicator).

[Prior Art]

[0002]

15 Heretofore, in the field of radio communication system, HSDPA (High Speed Downlink Packet Access) has been standardized whereby a plurality of communication terminals share a high-speed, high-capacity downlink channel and perform high-speed packet transmission in  
20 the downlink (see, Patent Document 1).

[0003]

In the HSDPA system, the communication terminal transmits the signal called CQI (Channel Quality Indicator) representing the modulation method and  
25 spreading factor for packet data that allow demodulation in the communication terminal, in a cycle set by higher apparatus such as RNC (Radio Network Controller). The

2003-284512

9

base station receives the CQI, and, based on the CQIs from individual communication terminals, performs scheduling and selects the optimal modulation method, spreading factor, and others. Then, the base station  
5 modulates and encodes transmit data in accordance with the modulation method and spreading factor that are selected, and, based on the scheduling result, transmits data to the individual communication terminals. By this means, it is possible to adaptively change the  
10 transmission rate depending on the signal propagation environment and transmit great amount of data from the base station to the communication terminal.

[0004]

As to the method of transmitting the CQI, there is  
15 a method standardized in, for example, "3GPP, TS 25.214 V5.5.0 6A.1.2" (Non-patent Document 1). According to this method, the communication terminal calculates the CQI on a regular basis based on the parameter called feedback cycle  $k$  and transmits the calculated CQI to the  
20 base station. In addition, the communication terminal repeats transmitting the CQI to the base station for the number of times determined based on the parameter called "N\_CQI\_transmit".

[0005]

25 FIG.13 shows a configuration of a conventional communication terminal that transmits the CQI. In communication terminal 10, radio receiver 13 receives

2003-284512

10

a radio signal that is transmitted from a radio base station, via antenna 11 and antenna duplexer 12, performs predetermined radio processing, and thereafter transmits the result to despreader 14. Despreader 14 performs despreading processing on the signal inputted from radio receiver 13, and sends the signal after the despreading processing to demodulator 15 and SIR measurer 17. Demodulator 15 performs demodulation processing on the signal inputted from despreader 14 and sends the signal after the demodulation to decoder 16. Decoder 16 performs decoding processing on the signal after the demodulation and obtains the received data. In addition, SIR measurer 17 measures the SIR (Signal to Interference Ratio) of the signal inputted from despreader 14, and sends the measured SIR to CQI calculator 18. Based on the measured SIR, CQI calculator 18 determines downlink transmission rate information (i.e. CQI) that allows reception in communication terminal 10 and sends the result to transmit frame generator 19.

[0006]

Based on CQI update cycle information and CQI repetition count information stored in memory 24, CQI transmission timing controller 20 selects the CQI to transmit and the transmission timing of the CQI. In practice, CQI transmission timing controller 20 changes content of the CQI in a cycle in accordance with the

2003-284512

11

parameter feedback cycle  $k$  (i.e. CQI update cycle information), which is stored in memory 24, and sends a control signal, which commands to transmit the same CQI for the number of times in accordance with the parameter repetition (i.e. CQI repetition count information), which is stored in memory 24, to transmit frame generator 19. Incidentally, the CQI update cycle information and CQI repetition count information stored in memory 24 are configured by higher apparatus such as RNC, and are received via the radio base station.

[0007]

FIG.14 shows CQI transmission timings in the communication terminal where feedback cycle  $k$  is 3 (meaning that the CQI is calculated once every three sub-frames, and that the CQI is changed every three sub-frames and transmitted to the radio base station) and repetition is 2 (meaning that the same CQI is transmitted twice in consecutive sub-frames).

[0008]

In the periods in which the CQI is calculated (i.e. measurement reference periods), the communication terminal measures CQI 1 (FIG.14(a)) in measurement period Ref 1, which corresponds to sub-frame (SF) #0, and repeats transmitting CQI 1 in SF #1 and SF #2 in HS-DPCCH (High Speed-Dedicated Physical Control Channel) sub-frames (FIG.14(b)). Likewise, the communication terminal measures CQI2 in measurement

period Ref 2, which corresponds to SF #3, and repeats transmitting CQI 2 in SF #4 and SF #5. Incidentally, SF #0-SF #5 are formed with three slots each, designed such that the ACK/NACK signal is embedded in the first one slot and the CQI signal is embedded in the other two slots.

[0009]

Transmit frame generator 19 generates a transmit frame from transmit data and the CQI signal and sends the result to modulator 21. In practice, as mentioned above, in accordance with the control signal from CQI transmission timing controller 20, transmit frame generator 19 determines the position in the transmit frame where the CQI signal is embedded, and determines whether to embed the same CQI signal or embed a new, changed CQI signal, and generates the transmit frame.

[0010]

Modulator 21 modulates the transmit frame inputted from transmit frame generator 19 and sends the result to spreader 22. Spreader 22 spreads the signal after the modulation and sends the result to radio transmitter 23. Radio transmitter 23 performs predetermined radio processing on the signal after the spreading and transmits the result to the radio base station via antenna duplexer 12 and antenna 11.

[0011]

FIG.15 shows a configuration of a conventional radio base station that receives the CQI signal from

2003-284512

13

communication terminal 10 and transmits downlink signals based on the received CQI. In radio base station 30, radio receiver 33 receives a radio signal that is transmitted from communication terminal 10 via antenna 5 31 and antenna duplexer 32, performs predetermined radio processing, and thereafter sends the result to despreaders 34.

[0012]

Memory 44 stores the same CQI update cycle 10 information and CQI repetition count information as those stored in memory 24 in communication terminal 10. Consequently, CQI reception timing controller 35 determines the timing to receive the CQI from the same CQI update cycle information and CQI repetition count 15 information as those used in communication terminal 10, and sends reception timing information to despreaders 34. CQI reception timing controller 35 determines the number of times the CQI is combined from the same CQI update cycle information and CQI repetition count information 20 as those used in communication terminal 10, and sends combining count information to buffer 37 and decoder 38.

[0013]

FIG.16 shows CQI reception timings in radio base station 30, with the same parameters as in communication 25 terminal 10--that is, CQI feedback cycle  $k$  is 3 and repetition is 2. In this case, sub-frame (SF) #1 and SF #2 have a timing to receive CQI 1 and SF #4 and SF #5

2003-284512

14

have a timing to receive CQI 2. CQI 1 and CQI 2 are each combined twice.

[0014]

Despreader 34 despreads the signal inputted from  
5 radio receiver 33 in accordance with the CQI reception  
timing indicated by CQI reception timing controller 35  
and transmits the despread signal to demodulator 36.  
Demodulator 36 demodulates the signal inputted from  
despreader 34 and sends the demodulation result to buffer  
10 37. Of the signals inputted from demodulator 36, buffer  
37 keeps the CQI signal and sends the rest of the signals  
to decoder 38.

[0015]

Moreover, buffer 37 holds the CQIs in an equivalent  
15 number as the CQI combining count indicated by CQI  
reception timing controller 35, sends the CQI signals  
held to decoder 38, and thereafter erases the content  
of buffer 37. In FIG.16, when the number of the CQI  
signals held reaches two, buffer 37 outputs these CQI  
20 signals to decoder 38 and erases the content of buffer  
37.

[0016]

Decoder 38 decodes the signal after the  
demodulation inputted from buffer 37, and obtains the  
25 received data. In addition, decoder 38 combines and  
decodes the CQI signals inputted from buffer 37 in  
accordance with the CQI combining count indicated by CQI



2003-284512

15

reception timing controller 35, and sends the decoded CQI to scheduler 39. The CQI signals are decoded by the CQI combining count, meaning that all the CQI signals outputted from buffer 37 equal to the combining count  
5 in number, are combined and decoded. In FIG.16, the two CQI signals held in buffer 37 are combined and decoded to obtain one decoding result.

[0017]

Scheduler 39 determines the transmission rate of  
10 the transmit data based on the CQI inputted from decoder 38 and sends the result to transmit frame generator 40. Transmit frame generator 40 generates a transmit frame based on the transmission rate reported from scheduler 39, and sends the result to modulator 41. Modulator 41  
15 performs modulation processing on the signal inputted from transmit frame generator 40 and sends the modulated signal to spreader 42. Incidentally, the modulation method in modulator 41 can be changed depending on the transmission rates. Spreader 42 performs spread  
20 modulation on the signal after the modulation and sends the spreading result to radio transmitter 43. Radio transmitter 43 performs predetermined radio processing on the signal after the spread-modulation and transmits the result to communication terminal 10 via antenna  
25 duplexer 32 and antenna 31.

[Patent Document 1] Laid-Open Japanese Patent  
Application Publication No.2000-151623

[Non-patent Document 1] "3GPP, TS 25.214 V5.5.0  
6A.1.2"

[Problems to be Solved by the Invention]

[0018]

5        However, as mentioned above, in a system where the  
CQI update cycle and CQI repetition count are designated,  
problems might occur depending on the combinations of  
the CQI update cycle and CQI repetition count.

[0019]

10        FIG.17 illustrates an example of such problem.  
FIG.17 shows CQI transmission timings in the  
communication terminal, where CQI feedback cycle  $k$  is  
2 (meaning that the CQI is calculated once every two  
sub-frames and the CQI is changed every two sub-frames  
15 and sent to the radio base station), and repetition is  
3 (meaning that the same CQI is transmitted three times  
in consecutive sub-frames).

[0020]

20        In the periods (Measurement Reference Periods) in  
which the CQI is calculated, the communication terminal  
measures CQI 1 in measurement period Ref 1, which  
corresponds to sub-frame (SF) #0, and repeats  
transmitting CQI 1 in SF #1, SF #2, and SF #3 in HS-DPCCH  
sub-frames. In addition, CQI 2 is measured in  
25 measurement period Ref 2, which corresponds to SF #2,  
and transmitted in SF #3, SF #4, and SF #5.

[0021]

2003-284512

17

As a result, a transmission timing of CQI 1 and a transmission timing of CQI 2 overlap in SF#3. Moreover, it is not clear whether CQI 2 is transmitted in SF #4. Likewise, a transmission timing of CQI 2 and a transmission timing of CQI 3 overlap in SF #5, and a transmission timing of CQI 3 and a transmission timing of CQI 4 overlap in SF #7.

[0022]

This creates the problem that the communication terminal becomes unable to determine which CQI to transmit in the sub-frames where transmission timings overlap. If the communication terminal blindly selects one of the CQIs and transmits it, this might result in a case where the received power of the CQI obtained in the base station apparatus by means of combining, is insufficient and the CQI is restored erroneously. If the error rate of the CQI increases, error rate characteristics in the downlink will also deteriorate, and, consequently, the amount of traffic in the downlink decreases.

[0023]

The present invention has been made with consideration given to the aforementioned problems and aims to provide a radio transmission apparatus, radio receiving apparatus, radio communication system, radio transmission method and radio reception method, that can prevent deterioration in CQI error rate characteristics

even when CQI update cycle information and CQI repetition count information are configured such that a transmission/reception timing of a CQI that is based on the CQI update cycle information and a  
5 transmission/reception timing of a CQI that is based on the CQI repetition count information overlap.

[Means for Solving the Problems]

[0024]

In order to solve the aforementioned problems, a  
10 radio transmission apparatus according to the present invention is a radio transmission apparatus that measures channel quality between the radio transmission apparatus and a communicating party and transmits to the communicating party a CQI (Channel Quality Indicator)  
15 that represents a measurement value, and adopts a configuration including a memory that stores CQI update cycle information representing an update cycle of the CQI and CQI repetition count information representing how many consecutive times the same CQI is transmitted;  
20 and a CQI transmitter that, when a transmission timing of a CQI that is based on the CQI update cycle information and a transmission timing of a CQI that is based on the CQI repetition count information overlap, transmits the CQI based on the repetition count information to the  
25 communicating party with priority.

[0025]

According to the above configuration, even when a

2003-284512

19

transmission timing of the CQI based on the CQI update  
cycle information and a transmission timing of the CQI  
based on the CQI repetition count information overlap,  
it is clear based on which information the CQI is  
5 transmitted. In addition, the CQI based on the CQI  
repetition count information is transmitted with  
priority, so that received power of the CQI at the  
receiving side can be secured, and, as a result,  
deterioration in CQI error rate characteristics at the  
10 receiving side can be prevented.

[0026]

The radio transmission apparatus of the present  
invention adopts a configuration wherein, when the  
transmission timing of the CQI based on the CQI update  
15 cycle information and the transmission timing of the CQI  
based on the CQI repetition count information overlap,  
the radio transmission apparatus reports to a higher  
apparatus that the CQI update cycle information and CQI  
repetition count information in use have an error,  
20 receives reconfigured CQI update cycle information and  
CQI repetition count information from the higher  
apparatus and stores these information in the memory;  
and wherein the CQI transmitter receives the  
reconfigured CQI update cycle information and CQI  
25 repetition count information and thereafter transmits  
the CQI to the communicating party based on the  
reconfigured CQI update cycle information and CQI

2003-284512

20

repetition count information.

[0027]

According to the above configuration, the CQI is transmitted using the CQI update cycle information and CQI repetition count information that are reconfigured by the higher apparatus, so that a transmission timing of the CQI based on the CQI update cycle information and a transmission timing of the CQI based on the CQI repetition count information do not overlap, and, as a result, the CQI is reliably transmitted to the communicating party. In addition, the CQI update cycle information and CQI repetition count are reconfigured in the higher apparatus, so that the same information can be reported to and configured in the communicating party and the CQI can be transmitted and received with the communicating party using the same reconfigured information. As a result, the communicating party is able to reliably combine the same CQIs and decode the CQI without an error.

20 [0028]

The radio transmission apparatus of the present invention adopts a configuration wherein, when the transmission timing of the CQI based on the CQI update cycle information and the transmission timing of the CQI based on the CQI repetition count information overlap, the radio transmission apparatus reports to the communicating party that the CQI update cycle

2003-284512

21

information and CQI repetition count information in use have an error, receives reconfigured CQI update cycle information and CQI repetition count information from the communicating party and stores these information in the memory; and wherein the CQI transmitter receives the reconfigured CQI update cycle information and CQI repetition count information and thereafter transmits the CQI to the communicating party based on the reconfigured CQI update cycle information and CQI repetition count information.

[0029]

According to the above configuration, the CQI is transmitted using the CQI update cycle information and CQI repetition count information that are reconfigured by the communicating party, so that a transmission timing of the CQI based on the CQI update cycle information and a transmission timing of the CQI based on the CQI repetition count information do not overlap, and, as a result, the CQI is reliably transmitted to the communicating party. In addition, the CQI update cycle information and CQI repetition count are reconfigured by the communicating party, so that the CQI can be transmitted and received between the radio transmission apparatus and the communicating party using the same reconfigured information. As a result, the communicating party is able to reliably combine the same CQIs and decode the CQI without an error.

2003-284512

22

[0030]

The radio transmission apparatus of the present invention adopts a configuration wherein, when the transmission timing of the CQI based on the CQI update cycle information and the transmission timing of the CQI based on the CQI repetition count information overlap, the radio transmission apparatus reconfigures the CQI update cycle information and CQI repetition count information anew such that the transmission timings do not overlap, stores the reconfigured CQI update cycle information and CQI repetition count information in the memory, and reports the reconfigured information to the communicating party; and wherein the CQI transmitter receives the reconfigured CQI update cycle information and CQI repetition count information and thereafter transmits the CQI to the communicating party based on the reconfigured CQI update cycle information and CQI repetition count information.

[0031]

According to the above configuration, the CQI is transmitted using the reconfigured CQI update cycle information and CQI repetition count information, so that a transmission timing of the CQI based on the CQI update cycle information and a transmission timing of the CQI based on the CQI repetition count information do not overlap, and, as a result, the CQI can be reliably transmitted to the communicating party. In addition,



2003-284512

23

the reconfigured CQI update cycle information and CQI repetition count information are reported to the communicating party, so that the CQI can be transmitted and received between the radio transmission apparatus and the communicating party using the same reconfigured  
5 information. As a result, the communicating party is able to reliably combine the same CQIs and decode the CQI without an error.

[0032]

10 The radio transmission apparatus of the present invention adopts a configuration wherein, of the CQI update cycle information and the CQI repetition count information, the CQI update cycle information alone is reconfigured.

15 [0033]

According to the above configuration, in order not to make a transmission timing of the CQI that is based on the CQI update cycle information and a transmission timing of the CQI that is based on the CQI repetition  
20 count information overlap, in practice, it is possible to make the CQI update cycle information longer or decrease the CQI repetition count information, however, the CQI update cycle information alone is reconfigured without changing the CQI repetition count information,  
25 thereby making it possible to secure the combined gain of the CQI upon decoding and prevent deterioration in CQI error rate characteristics upon reconfiguration.

[0034]

A radio reception apparatus according to the present invention is a radio reception apparatus that receives a CQI (Channel Quality Indicator) representing channel quality between the radio reception apparatus and a communicating party and decodes the CQI, and adopts a configuration including a memory that stores CQI update cycle information representing an update cycle of the CQI and CQI repetition count information representing how many consecutive times the same CQI is transmitted and decoded; and a CQI receiver and decoder that, when a reception timing of a CQI that is based on the CQI update cycle information and a transmission timing of a CQI that is based on the CQI repetition count information overlap, receives and decodes the CQI based on the CQI repetition count information with priority.

[0035]

According to the above configuration, when a reception timing of the CQI based on the CQI update cycle information and a reception timing of the CQI based on the CQI repetition count information overlap, it is clear based on which information the CQI is received. In addition, the CQI based on the CQI repetition count information is received and decoded with priority, so that the received power of the CQI is secured and deterioration in CQI error rate characteristics can be prevented.

2003-284512

25

[0036]

The radio reception apparatus of the present invention adopts a configuration wherein, when the reception timing of the CQI based on the CQI update cycle information and the reception timing of the CQI based on the CQI repetition count information overlap, the radio reception apparatus reports to a higher apparatus that the CQI update cycle information and CQI repetition count information in use have an error, receives reconfigured CQI update cycle information and CQI repetition count information from the higher apparatus and stores these information in the memory; and wherein the CQI receiver and decoder receives the reconfigured CQI update cycle information and CQI repetition count information and thereafter receives and decodes the CQI based on the reconfigured CQI update cycle information and CQI repetition count information.

[0037]

According to the above configuration, the CQI is received and decoded using the CQI update cycle information and CQI repetition count information that are reconfigured by the higher apparatus, so that a reception timing of the CQI based on the CQI update cycle information and a reception timing of the CQI based on the CQI repetition count information do not overlap, and, as a result, the same CQIs can be reliably combined upon decoding and deterioration in CQI error rate

characteristics can be prevented.

[0038]

The radio reception apparatus of the present invention adopts a configuration wherein, when the  
5 reception timing of the CQI based on the CQI update cycle information and the reception timing of the CQI based on the CQI repetition count information overlap, the radio reception apparatus reconfigures the CQI update cycle information and CQI repetition count information  
10 anew such that the reception timings do not overlap, stores the reconfigured CQI update cycle information and CQI repetition count information in the memory, and reports these new information to the communicating party; and wherein the CQI receiver and decoder receives  
15 and decodes the CQI based on the reconfigured CQI update cycle information and CQI repetition count information after the CQI update cycle information and CQI repetition count information are reconfigured.

[0039]

20 According to the above configuration, the CQI is received and decoded using the reconfigured CQI update cycle information and CQI repetition count information, so that a reception timing of the CQI based on the CQI update cycle information and a reception timing of the  
25 CQI based on CQI repetition count information do not overlap, with the result that the same CQIs can be reliably combined upon decoding and deterioration in CQI

2003-284512

27

error rate characteristics can be prevented. In addition, the reconfigured CQI update cycle information and CQI repetition count information are reported to the communicating party, so that the CQI can be transmitted and received between the radio reception apparatus and the communicating party using the same reconfigured information. As a result, the same CQIs can be reliably combined, and therefore the CQI can be decoded without an error.

10 [0040]

The radio reception apparatus of the present invention adopts a configuration wherein, of the CQI update cycle information and the CQI repetition count information, the CQI update cycle information alone is reconfigured.

[0041]

According to the above configuration, in order not to make a reception timing of the CQI that is based on the CQI update cycle information and a reception timing of the CQI that is based on the CQI repetition count information overlap, in practice, it is possible to make the CQI update cycle information longer or decrease the CQI repetition count information; however, the CQI update cycle information alone is reconfigured without changing the CQI repetition count information, thereby securing the combined gain of the CQI upon decoding and preventing deterioration in CQI error rate

2003-284512

28

characteristics upon reconfiguration.

[0042]

A communication terminal apparatus of the present invention includes the aforementioned radio transmission apparatus.

[0043]

A radio base station of the present invention includes the aforementioned radio reception apparatus.

[0044]

10 A radio communication system of the present invention is a radio communication system including a communication terminal apparatus that transmits a CQI based on predetermined CQI update cycle information and CQI repetition count information, and a radio base station apparatus that receives and decodes the CQI based on the predetermined CQI update cycle information and CQI repetition count information, and adopts a configuration wherein the communication terminal apparatus transmits the CQI that is based on the CQI repetition count information with priority and the radio base station apparatus receives and decodes the CQI based on the CQI repetition count information with priority.

[0045]

25 According to the above configuration, when a transmission timing of the CQI based on the CQI update cycle information and a transmission timing of the CQI based on the CQI repetition count information overlap

2003-284512

29

in the communication terminal apparatus, or even when a reception timing of the CQI based on the CQI update cycle information and a reception timing of the CQI based on the CQI repetition count information overlap in the radio base station apparatus, the radio base station apparatus adequately combines the same CQIs transmitted in repetition from the communication terminal apparatus and decodes the result. In addition, the CQI based on the CQI repetition count information is transmitted and received with priority, so that the combined gain of the CQI can be secured.

[0046]

The radio communication system of the present invention adopts a configuration further including a higher apparatus that controls a plurality of radio base station apparatuses, wherein, when a transmission timing of a CQI that is based on the CQI update cycle information and a transmission timing of a CQI that is based on the CQI repetition count information overlap, or when a reception timing of the CQI based on the CQI update cycle information and a reception timing of the CQI based on the CQI repetition count information overlap, the upper apparatus receives information indicating the overlap from the communication terminal apparatus or the radio base station apparatus and reports new reconfigured CQI update cycle information and CQI repetition count information to both the communication terminal apparatus

2003-284512

30

and the radio base station apparatus.

[0047]

According to the above configuration, the CQI update cycle information and CQI repetition count information are reconfigured in the higher apparatus, so that the same reconfigured information can be set in the communication terminal apparatus and the radio base station apparatus and the communication terminal apparatus and the radio base station apparatus are able to transmit and receive the CQI using the same reconfigured information. As a result, the radio base station can reliably combine the same CQIs and decode the CQI without error.

[0048]

A radio transmission method of the present invention is a radio transmission method that measures channel quality between a radio transmission apparatus and a communicating party and transmits to the communicating party a CQI (Channel Quality Indicator) that represents a measurement value, whereby, when a transmission timing of a CQI that is based on predetermined CQI update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, the CQI based on the CQI repetition count information is transmitted with priority.

[0049]



2003-284512

31

A radio reception method of the present invention is a radio reception method that receives, from a communicating party, a CQI (Channel Quality Indicator) representing channel quality between a radio reception apparatus and the communicating party and decodes the CQI, whereby, when a reception timing of a CQI that is based on predetermined CQI update cycle information and a reception timing of a CQI that is based on CQI repetition count information overlap, the CQI based on the CQI repetition count information is received and decoded with priority.

[Effects of the Invention]

[0050]

Thus, according to the present invention, when CQI is transmitted and received based on CQI update cycle information and CQI repetition count information, the CQI repetition count is given priority to transmit CQI, and CQI is received and decoded, so that even when CQI update cycle information and CQI repetition count information are configured such that a transmission or reception timing of a CQI that is based on the CQI update cycle information and a transmission or reception timing of a CQI that is based on the CQI repetition count information overlap, deterioration in CQI error rate characteristics can be prevented.

[Embodiments of the Invention]

[0051]

2003-284512

32

The essence of the present invention is that when a transmission timing of a CQI that is based on predetermined CQI update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, CQI based on the  
5 repletion count information is transmitted with priority. Likewise, the essence of the present invention is that when a reception timing of a CQI that is based on predetermined CQI update cycle information and a  
10 reception timing of a CQI that is based on CQI repetition count information overlap, the CQI repetition count is given priority to perform reception and decoding processing.

[0052]

15 This makes it possible to reliably secure reception power of CQIs combined at a receiving side.

[0053]

Now, embodiments of the present invention will be described in detail with reference to the accompanying  
20 drawings.

[0054]

(Embodiment 1)

FIG.1 shows the configuration of a communication terminal in accordance with Embodiment 1 of the present  
25 invention. In communication terminal 100, radio receiver 103 receives a radio signal that is transmitted from a radio base station via antenna 101 and antenna

2003-284512

33

duplexer 102, performs predetermined radio processing,  
and thereafter sends the result to desreader 104.  
Desreader 104 performs despreading processing on the  
signal inputted from radio receiver 103 and sends the  
5 signal after the despreading processing to demodulator  
105 and SIR measurer 107. Demodulator 105 performs  
demodulation processing on the signal inputted from  
desreader 104 and sends the signal after the  
demodulation to decoder 106. Decoder 106 performs  
10 decoding processing on the signal after the demodulation  
and obtains the received data. In addition, SIR measurer  
107 measures the SIR of the signal inputted from  
desreader 104 and sends the measured SIR to CQI  
calculator 108. Based on the measured SIR, CQI  
15 calculator 108 determines downlink transmission rate  
information (i.e. CQI) that enables reception in  
communication terminal 100, and sends the result to  
transmit frame generator 109.

[0055]

20 Based on CQI update cycle information and CQI  
repetition count information stored in memory 121, CQI  
transmission timing controller 110 selects the  
transmission timing of the CQI and the CQI to transmit.  
In practice, CQI transmission timing controller 110  
25 changes content of the CQI in a cycle in accordance with  
feedback cycle k (i.e. CQI update cycle information),  
which is a parameter stored in memory 121, and sends a

2003-284512

34

control signal, which commands to transmit the same CQI for the number of times in accordance with the parameter repetition (i.e. CQI repetition count information), which is stored in memory 121, to transmit frame generator 109. Incidentally, the CQI update cycle information and CQI repetition count information stored in memory 121 are configured by higher apparatus such as RNC and received via the radio base station.

[0056]

10 In addition to the above-described configuration, this communication terminal 100 of the present embodiment has CQI transmission timing priority determiner 120. Now, when a transmission timing of a CQI that is based on the CQI update cycle information and  
15 a transmission timing of a CQI that is based on the CQI repetition count information overlap, CQI transmission timing controller 110 reports this overlap of transmission timings to CQI transmission timing priority determiner 120. Upon receiving information indicating  
20 the overlap of transmission timings, CQI transmission timing priority determiner 120 gives a command to transmit the CQI based on repetition with priority, to CQI transmission timing controller 110. CQI transmission timing controller 110 follows the command  
25 from CQI transmission timing priority determiner 120 and gives the timing to transmit the CQI and a command to transmit the CQI based on repetition with priority, to

2003-284512

35

transmit frame generator 109.

[0057]

Transmit frame generator 109 generates a transmit frame from transmit data and the CQI signal, and sends  
5 the result to modulator 111. In practice, as mentioned above, in accordance with the control signal from CQI transmission timing controller 110, transmit frame generator 109 determines the position in the transmit frame where the CQI signal is embedded, and determines  
10 whether to embed the same CQI signal or embed a new, changed CQI signal, and generates the transmit frame.  
[0058]

Thus, when a transmission timing of the CQI that is based on the CQI update cycle information and a  
15 transmission timing of the CQI that is based on the CQI repetition count information overlap, CQI transmission timing controller 110, CQI transmission timing priority determiner 120, and transmit frame generator 109 operate as a CQI transmission unit that transmits the CQI based  
20 on the CQI repetition count information with priority.  
[0059]

Modulator 111 modulates the transmit frame inputted from transmit frame generator 109 and sends the signal after the modulation to spreader 112. Spreader  
25 112 spreads the signal after the modulation and sends the signal after the despreading to radio transmitter 113. Radio transmitter 113 performs predetermined

2003-284512

36

radio processing on the signal after the spreading and transmits the signal after the radio processing to the radio base station via antenna duplexer 102 and antenna 101.

5 [0060]

FIG.2 shows the configuration of the radio base station that receives the CQI signal from communication terminal 100 and transmits downlink signals based on the received CQI. In radio base station 200, radio receiver 10 203 receives a radio signal transmitted from communication terminal 100 via antenna 201 and antenna duplexer 202, performs predetermined radio processing, and thereafter sends the result to despreaders 204.

[0061]

15 Memory 221 stores the same CQI update cycle information and CQI repetition count information as those stored in memory 121 of communication terminal 100. Consequently, CQI reception timing controller 205 determines the timing to receive the CQI from the same 20 CQI update cycle information and CQI repetition count information as the ones utilized in communication terminal 100, and sends CQI reception timing information to despreaders 204. CQI reception timing controller 205 determines the number of times the CQI is combined from 25 the same CQI update cycle information and CQI repetition count information as those utilized in communication terminal 100, and sends combining count information to

2003-284512

37

buffer 207 and decoder 208.

[0062]

In addition to the above-noted configuration, this radio base station 200 of the present embodiment has CQI reception timing priority determiner 220. Now, when a reception timing of a CQI that is based on the CQI update cycle information stored in memory 221 and a reception timing of a CQI that is based on the CQI repetition count information stored in memory 221 overlap, CQI reception timing controller 205 reports this overlap of reception timings to CQI reception timing priority determiner 220. Upon receiving information indicating the overlap of reception timings, CQI reception timing priority determiner 220 gives a command to receive the CQI based on repetition with priority, to CQI reception timing controller 205. In accordance with the command from CQI reception timing priority determiner 220, CQI reception timing controller 205 determines the timing to receive the CQI and sends reception timing information to despreaders 204. In addition, in accordance with the command from CQI reception timing priority determiner 220, CQI reception timing controller 205 determines the number of times the CQI is combined, and sends this combining count to buffer 207 and decoder 208.

25 [0063]

In accordance with the CQI reception timing indicated by CQI reception timing controller 205,

2003-284512

38

despreader 204 despreads the signal inputted from radio receiver 203 and sends the signal after the despreading to demodulator 206. Demodulator 206 demodulates the signal inputted from despreader 204 and sends the signal  
5 after the demodulation to buffer 207. Of all signals inputted from demodulator 206, buffer 207 keeps the CQI signals and sends the rest of the signals to decoder 208.  
[0064]

In addition, buffer 207 holds the CQIs in an  
10 equivalent number to the CQI combining count indicated by CQI reception timing controller 205, sends the CQI signals held to decoder 208, and thereafter erases the content of buffer 207. 208 decodes the signals after the demodulation, inputted from buffer 207, and obtains the  
15 received data. In addition, decoder 208 combines and decodes the CQI signals inputted from buffer 207 in accordance with the CQI combining count indicated by CQI reception timing controller 205, and sends the decoded CQI to scheduler 209.

20 [0065]

Thus, when a reception timing of the CQI that is based on the CQI update cycle information and a reception timing of the CQI that is based on the CQI repetition count information overlap, CQI reception timing  
25 controller 205, CQI reception timing priority determiner 220, despreader 204, buffer 207 and decoder 208 operate as a CQI reception and decoding unit that receives and



decodes the CQI that is based on the CQI repetition count information with priority.

[0066]

Scheduler 209 determines the transmission rate of  
5 the transmit data based on the CQI inputted from decoder  
208, and sends transmission rate information to transmit  
frame generator 210. Transmit frame generator 210  
generates a transmit frame based on the transmission rate  
reported from scheduler 209 and sends the result to  
10 modulator 211. Modulator 211 performs modulation  
processing on the signal inputted from transmit frame  
generator 210 and sends the signal after the modulation  
to spreader 212. Incidentally, the modulation method in  
modulator 211 can be changed depending on the  
15 transmission rates. Spreader 212 performs spread  
modulation on the signal after the modulation and sends  
the signal after the spreading to radio transmitter 213.  
Radio transmitter 213 performs predetermined radio  
processing on the signal after the spread modulation and  
20 transmits the signal after the radio processing to  
communication terminal 100 via antenna duplexer 202 and  
antenna 201.

[0067]

The operation of the present embodiment will be  
25 explained next. FIG.3 illustrates CQI transmission  
timings in communication terminal 100 of the present  
embodiment, where CQI feedback cycle  $k$  is 2 (meaning that

the CQI is calculated once every two sub-frames and that the CQI is changed every two sub-frames and transmitted to the radio base station), and repetition is 3 (meaning that the same CQI is transmitted three times in consecutive sub-frames).

[0068]

In the periods in which the CQI is calculated, communication terminal 100 measures CQI 1 (FIG.3(a)) in measurement period Ref 1, which corresponds to sub-frame (SF) #0, and repeats transmitting CQI 1 in SF #1, SF #2, and SF #3 in HS-DPCCH (High Speed-Dedicated Physical Control Channel) sub-frames (FIG.3(b)). If, for example, these CQIs are arranged simply based on the CQI update cycle information and CQI repetition count information, CQI 2, which is measured in Ref 2 that corresponds to SF #3, will be transmitted in SF #3, SF #4, and SF #5, and a transmission timing of CQI 1 and a transmission timing of CQI 2 will overlap in SF #3. In addition, it becomes unclear whether or not CQI 2 is transmitted in SF #4. Likewise, a transmission timing of CQI 2 and a transmission timing of CQI 3 overlap in SF #5 and a transmission timing of CQI 3 and a transmission timing of CQI 4 overlap in SF #7.

[0069]

However, communication terminal 100 according to the present embodiment is designed to transmit the CQI based on repetition with priority, and therefore CQI 1

2003-284512

41

is transmitted in SF #3 and CQI 3 is transmitted in SF #5 and SF #7. Moreover, if a CQI is cancelled transmission because a CQI based on repetition is transmitted with priority, the former will not be transmitted at all. In other words, the transmissions of CQI 2 and CQI 4 are stopped.

[0070]

Thus, the present embodiment is designed to transmit the CQI based on repetition with priority, so that the combined gain of the CQI is reliably secured at the receiving side. As a result, it becomes possible to prevent deterioration in CQI error rate characteristics and minimize the decrease in the amount of transmit data in the downlink.

15 [0071]

Here, the situation where a transmission timing of a CQI that is based on CQI update cycle information and a transmission timing of a CQI that is based on repetition count information overlap is likely to occur when the CQI update cycle information is set short and the CQI repetition count information is set large. Here, making the CQI update cycle short makes possible transmitting good CQIs when the signal propagation environment changes rapidly in short time, and making the CQI repetition count large makes the combined gain of the CQIs large and improves error rate characteristics. When a transmission timing of a CQI that is based on CQI

2003-284512

42

update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, it is certainly possible to prioritize one over the other; however, the present inventor considered that even if a good CQI is transmitted in a signal propagation environment that changes rapidly in short time, this CQI is more likely to have poor error rate characteristics and decrease the amount of transmit data in the downlink, and therefore the present embodiment is designed to transmit the CQI, which is based on repetition, with priority.

[0072]

Moreover, if a CQI is cancelled transmission because a CQI based on repetition is transmitted with priority, the former will not be transmitted at all. Consequently, when a CQI is calculated, it is quickly transmitted. It is certainly possible to place CQI 2 in SF #4, SF #5, and SF #6. However, this then places CQI 3 in SF #7, SF #8, and SF #9 and causes a delay from the time the CQI is calculated until the time the CQI is transmitted to the radio base station. The present embodiment is designed such that if a CQI is cancelled transmission because a CQI based on repetition is transmitted with priority, the former will not be transmitted at all, and therefore the present embodiment makes it possible to eliminate the above-mentioned delay, and, using this CQI, enables the radio base station that

performs downlink transmission to perform transmission at adequate transmission rates in accordance with the signal propagation environment.

[0073]

5           FIG.4 illustrates CQI reception timings in radio base station 200 according to the present embodiment where, with the same parameters as in communication terminal 100--that is, CQI feedback cycle  $k$  is 2 and repetition is 3.

10   [0074]

When radio base station 200 tries to perform CQI reception processing based simply on the CQI update cycle information and repetition count information, a reception timing of CQI 1 and a reception timing of CQI 2 overlap in sub-frame (SF) #3. In addition, in SF #4, it is unclear whether or not CQI 2 is received. Likewise, a reception timing of CQI 2 and a reception timing of CQI 3 overlap in SF #5, and a reception timing of CQI 3 and a reception timing of CQI 4 overlap in SF #7.

20   [0075]

However, at these reception timings, radio base station 200 of the present embodiment receives and decodes the CQIs based on repetition with priority, so that it is clear which CQI is received in each sub-frame. As a result, the same CQIs can be reliably combined upon combination in decoder 208.

[0076]

2003-284512

44

To be more specific, radio base station 200 sets a reception timing of CQI 1 in SF #1, SF #2, and SF #3, and sets a reception timing of CQI 3 in SF #5, SF #6, and SF #7. Then, decoder 208 combines the CQI 1's from  
5 SF #1, SF #2, and SF #3, and combines the CQI 3's from SF #5, SF #6, and SF #7. Consequently, CQI 1 and CQI 3 are each combined three times. In comparison to the case where the communication terminal and the radio base station both prioritize transmission of the CQI that is  
10 based on CQI update cycle information, radio base station 200 combines the CQI three times and decodes the result, so that the CQI has sufficient received power and makes it possible to have a correct and errorless CQI.

[0077]

15 FIGS 5, 6, and 8 show comparative examples in relation to the present embodiment. FIG.5 illustrates a first comparative example, where the communication terminal transmits the CQIs that are based on repetition count information with priority ("UE transmission") and  
20 the radio base station receives the CQIs that are based on CQI update cycle information with priority ("BTS reception"). In this case, although the communication terminal combines CQI 1's three times and transmits the result with enough transmission power to enable  
25 reception and decoding, the radio base station combines CQI 1's twice in sub-frame (SF) #1 and SF #2 and receives and decodes the result, with the result that the CQI has

2003-284512

45

insufficient received power and the probability the CQI results in an error increases. In addition, although the communication terminal transmits CQI 1 only in SF#3, the radio base station judges that CQI 2 is transmitted twice in SF#3 and SF#4, and combines one CQI 1 and nothing twice and receives and decodes the result, with the result that the probability the CQI results in an error increases further.

[0078]

FIG. 6 illustrates a second comparative example, where the communication terminal transmits the CQIs that are based on CQI update cycle information with priority ("UE transmission") and the radio base station receives the CQIs that are based on repetition count information with priority ("BTS reception"). In this case, the communication terminal transmits CQI 1 twice in SF #1 and in SF #2 in repetition, and transmits CQI 2 twice in SF #3 and in SF #4 in repetition. The radio base station judges that CQI 1 is transmitted three times in SF #1, SF #2, and SF #3, and combines two CQI 1's and one CQI 2, three times in all, and receives and decodes the result. Consequently, the probability the CQI results in an error increases further.

[0079]

FIG. 7 illustrates a third comparative example, where the communication terminal and the radio base station both transmit (UE transmission) and receives (BTS

2003-284512

46

reception) the CQIs that are based on CQI update cycle information with priority. In this case, the communication terminal transmits CQI 1 twice in sub-frame (SF) #1 and in SF #2 in repetition and transmits CQI 2 in SF #3 and in SF #4 in repetition. Although the communication terminal combines CQI 1's three times and transmits the result with enough transmission power to enable reception and decoding, the radio base station combines CQI 2's twice in SF #3 and SF #4 and receives and decodes the result. Consequently, the both CQIs have insufficient received power and the probability CQI results in an error increases.

[0080]

In the above comparative examples, it is obvious that the CQI does not have sufficient received power and that the probability the CQI results in an error increases.

[0081]

Thus, according to the present embodiment, when the CQI signals are transmitted and received based on predetermined CQI update cycle information and CQI repetition count information, the CQI repetition count is given priority in CQI transmission and reception processing, with the result that the present embodiment makes possible communication terminal 100 and radio base station 200 that can prevent deterioration in CQI error rate characteristics.



2003-284512

47

[0082]

(Embodiment 2)

In this embodiment, when the communication terminal detects that a transmission timing of a CQI that is based on CQI update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, or when the radio base station detects that a transmission timing of a CQI that is based on CQI update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, the communication terminal or the radio base station transmits a detection signal (hereinafter "error signal") indicating the overlap to higher apparatus. Upon receiving the error signal, higher apparatus reconfigures the CQI update cycle information and CQI repetition count information anew such that transmission timings and reception timings do not overlap, and reports the reconfigured information to both the communication terminal and the radio base station.

[0083]

As shown in FIG.8, higher apparatus 300 and radio base station 400 are connected by wire, and radio base station 400 and communication terminal 500 are connected by radio. Higher apparatus 300 manages radio resource management in radio base station 400 and controls radio base station 400, including, for example, handover

2003-284512

48

control. Higher apparatus 300 is able to transmit information to communication terminal 500 via radio base station 400.

[0084]

5           FIG.9 shows the configuration of communication terminal 500 according to the present embodiment. Parts in FIG.9 that are identical to ones in FIG.1 are assigned the same reference numerals without further explanations. Like CQI transmission timing controller 110 in  
10   Embodiment 1, when a transmission timing of a CQI that is based on the CQI update cycle information stored in memory 121 and a transmission timing of a CQI that is based on the CQI repetition count information stored in memory 121 overlap, CQI transmission timing controller  
15   501 reports the overlap of transmission timings to CQI transmission timing priority determiner 120. Upon receiving information indicating the overlap of transmission timings, CQI transmission timing priority determiner 120 gives a command to transmit the CQI based  
20   on repetition with priority, to CQI transmission timing controller 501. CQI transmission timing controller 501 follows the command from CQI transmission timing priority determiner 120 and gives the timing to transmit the CQI and a command to transmit the CQI based on  
25   repetition with priority, to transmit frame generator 109.

[0085]

2003-284512

49

In addition, CQI transmission timing controller 501 of this embodiment produces an error signal upon detecting that a transmission timing of the CQI based on the CQI update cycle information and a transmission timing of the CQI that is based on the repetition count information overlap, and sends this error signal to transmit frame generator 109. Transmit frame generator 109 inserts the error signal in a transmit frame. The error signal includes the CQI update cycle information and CQI repetition count information that are then stored in memory 121. The error signal is transmitted to higher apparatus 300 via radio base station 400.

[0086]

Upon receiving the error signal from communication terminal 500, higher apparatus 300 configures new CQI update cycle information and CQI repetition count information such that a transmission timing of a CQI that is based on the CQI update cycle information and a transmission timing of a CQI that is based on the CQI repetition count information do not overlap, and transmits the new CQI update cycle information and CQI repetition count information to communication terminal 500 via radio base station 400.

[0087]

Communication terminal 500 receives the new CQI update cycle information and CQI repetition count information and stores them in memory 121. Thereafter,

2003-284512

50

the CQIs are transmitted using these new CQI update cycle information and CQI repetition count information. By this means, when later the CQIs are transmitted, a transmission timing of a CQI that is based on the CQI update cycle information and a transmission timing of a CQI that is based on the CQI repetition count information do not overlap.

[0088]

FIG.10 shows the configuration of radio base station 400 according to the present embodiment. Hereinafter, parts in FIG.10 that are identical to ones in FIG. 2 are assigned the same reference numerals without further explanations. Similar to CQI reception timing controller 205 in Embodiment 1, when a reception timing of a CQI that is based on the CQI update cycle information stored in memory 221 and a reception timing of a CQI that is based on the CQI repetition count information stored in memory 221 overlap, CQI reception timing controller 401 reports this overlap of reception timing to CQI reception timing priority determiner 220. Upon receiving information indicating the overlap of reception timings, CQI reception timing priority determiner 220 gives a command to receive the CQI based on repetition with priority, to CQI reception timing controller 401. In accordance with the command from CQI reception timing priority determiner 220, CQI reception timing controller 401 determines the timing to receive

2003-284512

51

the CQI and sends the result to despreader 204. In addition, in accordance with the command from CQI reception timing priority determiner 220, CQI reception timing controller 401 determines the number of times the CQI is combined, and sends this combining count to buffer 207 and decoder 208.

[0089]

In addition, CQI reception timing controller 401 produces an error signal (which includes the CQI update cycle information and CQI repetition count information) upon detecting that a transmission timing of the CQI that is based on the CQI update cycle information and a transmission timing of the CQI that is based on the repetition count information overlap, and sends this error signal to higher apparatus 300.

[0090]

Upon receiving the error signal from radio base station 400, higher apparatus 300 configures new CQI update cycle information and CQI repetition count information, and sends the new CQI update cycle information and CQI repetition count information to radio base station 400.

[0091]

Radio base station 400 receives the new CQI update cycle information and CQI repetition count information and stores them in memory 221. Thereafter, the CQIs are received and demodulated using these new CQI update cycle

2003-284512

52

information and CQI repetition count information. By this means, when later the CQIs are received, a reception timing of a CQI that is based on the CQI update cycle information and a reception timing of a CQI that is based on the CQI repetition count information do not overlap.  
[0092]

Thus, in the communication system of the present embodiment including higher apparatus 300, radio base station 400, and communication terminal 500, when a transmission or reception timing of a CQI that is based on CQI update cycle information and a transmission or reception timing of a CQI that is based on CQI repetition count information overlap in communication terminal 500 or in radio base station 400, this is reported to higher apparatus 300.  
[0093]

Upon receiving the report, higher apparatus 300 reconfigures the CQI update cycle information and CQI repetition count information, and sends the new configuration information to communication terminal 500 and radio base station 400. For ease of explanation, a case has been described above where, when communication terminal 500 produces an error signal, communication terminal 500 alone receives the new configuration information, and, when radio base station 400 produces an error signal, radio base station 400 alone receives the new configuration information; however, the new

2003-284512

53

configuration information is sent to both communication terminal 500 and radio base station 400 so that memory 121 and memory 221 hold the same information. In other words, when either communication terminal 500 or radio base station 400 produces an error signal, the new configuration information, which is configured in higher apparatus 300, is sent to both communication terminal 500 and radio base station 400, and later, communication terminal 500 and radio base station 400 perform transmission and reception using the new configuration information.

[0094]

This allows communication terminal 500 and radio base station 400 to perform CQI transmission processing and reception processing using the same new CQI update cycle information and CQI repetition count information, so that radio base station 400 is able to adequately combine the CQIs transmitted from communication terminal 500.

20 [0095]

According to the present embodiment, when higher apparatus 300 reconfigures the CQI update cycle information and CQI repetition count information, higher apparatus 300 reconfigures only the CQI update cycle information and does not change the CQI repetition count information. By this means, when the CQI is transmitted from communication terminal 500 to radio base station

2003-284512

54

400 using the new CQI update cycle information and the new CQI repetition count information, the probability the CQI results in an error decreases. As to the method of the reconfiguration, it is possible to maintain the CQI update cycle information as it is and decrease the CQI repetition count information; however, decreasing the CQI repetition count information has the risk of increasing the probability that the CQI results in an error such as mentioned above. Taking this into consideration, the present embodiment is designed to change the CQI update cycle information alone. For example, upon receiving from communication terminal 500 an error signal and information representing that feedback cycle  $k$  is 2 and repetition is 3, higher apparatus 300 reconfigures CQI feedback cycle  $k$  at 3 and repetition at 3, and reports new information representing that CQI feedback cycle  $k$  is 3 and repetition is 3, to both communication terminal 500 and radio base station 400.

20 [0096]

According to the present embodiment, when communication terminal 500 detects that a transmission timing of a CQI that is based on CQI update cycle information and a transmission timing of a CQI that is based on repetition count information overlap, or when radio base station 400 detects that a reception timing of a CQI based on CQI update cycle information and a



2003-284512

55

reception timing of a CQI based upon CQI repetition count information overlap, the CQI update cycle information and CQI repetition count information are reconfigured, so that communication terminal 500 and radio base station 5 400 use the new CQI update cycle information and CQI repetition count information and perform CQI transmission processing and CQI reception processing such that there transmission timings and reception timings of the CQIs do not overlap.

10 [0097]

As to the reconfiguration, the CQI repetition count information is kept unchanged and the CQI update cycle information alone is changed, thereby making the probability less that, when the CQI signal is transmitted 15 from communication terminal 500 to radio base station 400 using the new CQI update cycle information and the new CQI repetition count information, the CQI results in an error.

[0098]

20 Now, although a case has been described above with the present embodiment where the CQI is reconfigured in higher apparatus 300, the present invention is by no means limited to this, and it is possible to reconfigure the CQI in radio base station 400. In that case, radio 25 base station 400 performs the reconfiguration upon receiving an error signal from communication terminal 500, sends the new configuration information to

2003-284512

56

communication terminal 500 and higher apparatus 300, and stores the same information in memory 221 in radio base station 400.

[0099]

5           In addition, although a case has been described above with the present embodiment where an error signal is transmitted including the CQI update cycle information (i.e. CQI feedback cycle k) and CQI repetition count information (i.e. repetition), it is  
10 possible to send only information that represents a timing overlap.

[0100]

Moreover, although a case has been described above with the present embodiment where the CQI update cycle  
15 information alone is changed, it is possible to reconfigure both the CQI update cycle information and CQI repetition count information. This applies to following Embodiment 3 as well.

[0101]

20           Moreover, although a case has been described above with the present embodiment where CQI transmission timing priority determiner 120 is provided as in Embodiment 1 and a CQI that is based on the CQI repetition count information is transmitted with priority over a  
25 CQI that is based on the CQI update cycle information, transmission timings of the CQIs do not overlap when the new, reconfigure CQI update cycle information and CQI

2003-284512

57

repetition count information are used, so that CQI transmission timing priority determiner 120 may not be necessary. In a similar fashion, although a case has been described above with the present embodiment where CQI reception timing priority determiner 220 is provided, and a CQI that is based on the CQI repetition count information is transmitted with priority over a CQI that is based on the CQI update cycle information, reception timings of the CQIs do not overlap when the new, reconfigured CQI update cycle information and CQI repetition count information are used, so that CQI reception timing priority determiner 220 may not be necessary. This applies to following Embodiment 3 as well.

15 [0102]

(Embodiment 3)

In this embodiment, when the communication terminal detects that a transmission timing of a CQI that is based on CQI update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, the CQI update cycle information and CQI repetition count information are reconfigured such that transmission timings of the CQIs do not overlap. In addition, in this embodiment, when the radio base station detects that a reception timing of a CQI that is based on CQI update cycle information and a reception timing of a CQI that is based

2003-284512

58

on CQI repetition count information overlap, the CQI update cycle information and CQI repetition count information are reconfigured such that reception timings of the CQIs do not overlap. Then, the communication terminal or radio base station reports the new, reconfigured information to higher apparatus. Upon receiving the new, reconfigured information from one of the communication terminal and the radio base station, higher apparatus reports the new reconfigured information to the other one of the communication terminal and the radio base station so that the communication terminal and the radio base station have the same configuration.

[0103]

FIG.11 shows the configuration of communication terminal 600 according to the present embodiment. Parts in FIG.11 that are identical to ones in FIG.1 are assigned the same reference numerals without further explanations. Like CQI transmission timing controller 110 in Embodiment 1, when a transmission timing of a CQI that is based on the CQI update cycle information stored in memory 121 and a transmission timing of a CQI that is based on the CQI repetition count information stored in memory 121 overlap, CQI transmission timing controller 601 reports the overlap of transmission timings to CQI transmission timing priority determiner 120. Upon receiving information indicating the overlap of

transmission timings, CQI transmission timing priority determiner 120 gives a command to transmit the CQI based on repetition with priority, to CQI transmission timing controller 601. CQI transmission timing controller 601 follows the command from CQI transmission timing priority determiner 120 and gives the timing to transmit the CQI and a command to transmit the CQI based on repetition with priority, to transmit frame generator 109.

10 [0104]

In addition, when CQI transmission timing controller 601 of this embodiment detects that a transmission timing of the CQI based on the CQI update cycle information and a transmission timing of the CQI that is based on the repetition count information overlap, CQI transmission timing controller 601 configures new CQI update cycle information and CQI repetition count information such that a transmission timing of the CQI based on the CQI update cycle information and a transmission timing of the CQI based on the CQI repetition count information do not overlap, stores the new CQI update cycle information and CQI repetition count information in memory 121, and sends these new information to transmit frame generator 109.

25 [0105]

Transmit frame generator 109 inserts the new CQI update cycle information and CQI repetition count

2003-284512

60

information in a transmit frame. The new CQI update cycle information and CQI repetition count information are then sent to higher apparatus.

[0106]

5           FIG.12 shows the configuration of radio base station 700 according to the present embodiment. Hereinafter, parts in FIG.12 that are identical to ones in FIG.2 are assigned the same reference numerals without further explanations. Similar to CQI reception timing controller 205 in Embodiment 1, when a reception timing of a CQI that is based on the CQI update cycle information stored in memory 221 and a reception timing of a CQI that is based on the CQI repetition count information stored in memory 221 overlap, CQI reception timing controller 15 701 reports this overlap of reception timing to CQI reception timing priority determiner 220. Upon receiving information indicating the overlap of reception timings, CQI reception timing priority determiner 220 gives a command to receive the CQI based on repetition with priority, to CQI reception timing controller 20 701. In accordance with the command from CQI reception timing priority determiner 220, CQI reception timing controller 701 determines the timing to receive the CQI and sends the result to despreader 204. In addition, in accordance with the command from CQI reception timing priority determiner 220, CQI reception timing controller 701 determines the number of times the

2003-284512

61

CQI is combined, and sends this combining count to buffer 207 and decoder 208.

[0107]

In addition, when CQI reception timing controller 5 701 of this embodiment detects that a reception timing of the CQI based on the CQI update cycle information and a reception timing of the CQI that is based on the repetition count information overlap, CQI reception timing controller 701 configures new CQI update cycle 10 information and CQI repetition count information such that a reception timing of the CQI based on the CQI update cycle information and a reception timing of the CQI based on the CQI repetition count information do not overlap, stores the new CQI update cycle information and CQI 15 repetition count information in memory 221, and reports these new information to higher apparatus 300.

[0108]

Upon receiving the new configuration from communication terminal 600 or radio base station 700, 20 higher apparatus 300 produces a command such that communication terminal 600 and radio base station 700 have the same configuration. For example, when higher apparatus 300 receives the new configuration information from communication terminal 600, higher apparatus 300 25 reports the same new configuration information to radio base station 700. By this means, communication terminal 600 and radio base station 700 reliably avoid using

2003-284512

62

different CQI update cycle information and CQI repetition count information, thereby allowing radio base station 700 to reliably combine the same CQIs.

[0109]

5       Incidentally, similar to Embodiment 2, in the present embodiment, the CQI repetition count information is kept unchanged and the CQI update cycle information alone is changed upon the reconfiguration. By this means, when the CQI signal is sent from communication terminal  
10 600 and radio base station 700 using the new CQI update cycle information and the new CQI repetition count information, the probability the CQI results in an error can be decreased..

[0110]

15 (Other embodiments)

Although cases have been described above with Embodiments 1-3 where the communication terminal transmits the CQI and the radio base station receives the CQI, the present invention is by no means limited  
20 to this, and it is possible to have the radio base station transmit the CQI and have the communication terminal receive the CQI, and the present invention would be applicable to a wide range of cases where transmission and reception of the CQI is performed using CQI update  
25 cycle information and CQI repetition count information.

[0111]

In addition, although a case has been described



2003-284512

63

above with Embodiment 3 where, when communication terminal 600 performs new set-up, communication terminal 600 reports the new configuration information to higher apparatus 300 and higher apparatus 300 reports the new configuration information to radio base station 700, it is equally possible to have communication terminal 600 report new configuration information to radio base station 700 and have radio base station 700 store the new configuration information in memory 221. In that case, radio base station 700 reports the new configuration information to higher apparatus 300. In a similar fashion, although a case has been described above with Embodiment 3 where, when radio base station 700 performs new set-up, radio base station 700 reports the new configuration information to higher apparatus 300 and higher apparatus 300 reports the new configuration information to communication terminal 600, it is equally possible to have radio base station 700 report the new configuration information directly to communication terminal 600. In that case, radio base station 700 reports the new configuration information to higher apparatus 300.

[0112]

Moreover, although cases have been described above with Embodiments 1-3 where an overlap of a transmission timing of a CQI that is based on CQI update cycle information and a transmission timing of a CQI that is

2003-284512

64

based on CQI repetition count information is detected, the CQI based on the CQI repetition count information is transmitted with priority, it is equally possible, when a transmission timing of a CQI that is based on the CQI update cycle information and a transmission timing of a CQI that is based on the CQI repetition count information overlap, to stop transmitting the CQIs. Likewise, when a reception timing of a CQI that is based on the CQI update cycle information and a reception timing of a CQI that is based on the CQI repetition count information overlap, it is possible to stop receiving and decoding the CQIs. By this means, receiving and decoding error CQIs can be avoided.

[0113]

Although cases have been described above with Embodiments 1-3 where, when a transmission timing of a CQI that is based on CQI update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, the CQI based on the CQI repetition count information is transmitted with priority, it is equally possible, when a transmission timing of a CQI that is based on other information than the CQI update cycle information and a transmission timing of a CQI that is based on the CQI repetition count information overlap, to transmit the CQI based on the repetition count information with priority and maintain the same advantages as in the above embodiments.

2003-284512

65

[0114]

For example, when an ACK/NACK signal is going to be transmitted, the CQI signal must be transmitted in the same sub-frame. If a transmission timing of this CQI and a transmission timing of a CQI that is based on the repetition count information overlap, the CQI based on the CQI repetition count information is transmitted with priority. In addition, if a request comes from higher apparatus that the CQI be transmitted at a timing other than a transmission timing of a CQI based on CQI update cycle information, and, if the transmission timing of this CQI and a transmission timing of a CQI that is based on CQI repetition count information overlap, the CQI based on the CQI repetition count information is transmitted with priority.

[0115]

Furthermore, although cases have been described above with Embodiments 1-3 where the CQI (or information of equivalent concept) is subject to transmission and reception, the present invention is by no means limited to CQI transmission and reception and is applicable to a wide range of cases where information is transmitted and received based on update cycle information and repetition count information.

25 [0116]

Further yet, although cases have been described above with Embodiments 1-3 where packets are transmitted

2003-284512

66

using HSDPA whereby packets for a plurality of communication terminal apparatuses are code-multiplexed in the same time slot, the present invention is by no means limited to this and is applicable to any type of communication where scheduling is performed by multiplexing packets for a plurality of communication terminal apparatuses.

[0117]

For example, the present invention is applicable to any type of communication where scheduling is performed by code-multiplexing, time-multiplexing, or frequency-multiplexing packets for a plurality of communication terminal apparatuses. When time-multiplexing is used, scheduling is performed across a plurality of time slots in a certain frame unit. When frequency-multiplexing is used, scheduling is performed per frequency in a time slot. When frequency-multiplexing is used, scheduling is performed per frequency in a time slot.

20 [0118]

The present invention is suitable for use in a radio transmission apparatus, radio receiving apparatus, radio communication system that are required to notify without error CQI (Channel Quality Indicator), for example.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0119]

2003-284512

67

[Fig. 1] A block diagram showing a configuration of a communication terminal according to Embodiment 1 of the present invention;

[Fig. 2] A block diagram showing a configuration of a radio base station according to Embodiment 1;

[Fig. 3] A view explaining CQI transmission timing in the communication terminal of Embodiment 1;

[Fig. 4] A view explaining CQI reception timings in the radio base station of Embodiment 1;

[Fig. 5] A view explaining transmission and reception timings in a first comparative example in comparison to the embodiment;

[Fig. 6] A view explaining transmission and reception timings in a second comparative example in comparison to the embodiment;

[Fig. 7] A view explaining transmission and reception timings in a third comparative example in comparison to the embodiment;

[Fig. 8] A block diagram showing a radio communication system according to Embodiments 2 and 3;

[Fig. 9] A block diagram showing a configuration of a communication terminal according to Embodiment 2;

[Fig. 10] A block diagram showing a configuration of a radio base station according to Embodiment 2;

[Fig. 11] A block diagram showing a configuration of communication terminal according to Embodiment 3;

[Fig. 12] A block diagram showing a configuration

2003-284512

68

of a radio base station according to Embodiment 3

[Fig. 13] A block diagram showing a configuration of a conventional communication terminal;

[Fig. 14] A view explaining a CQI transmission timing using CQI update cycle information and CQI repetition count information;

[Fig. 15] A block diagram showing a configuration of a conventional radio base station;

[Fig. 16] A view explaining a CQI reception timing using CQI update cycle information and CQI repetition count information; and

[Fig. 17] A view explaining a case where a CQI transmission timing based on CQI update cycle information and a CQI transmission timing based on CQI repetition count information overlap.

[Description of the Symbols]

[0120]

100, 500, 600: Communication Terminal

109: Transmit Frame Generator

20 110, 501, 601: CQI Transmission Timing Controller

120: CQI Transmission Timing Priority Determiner

121, 221: Memory

200, 400, 700: Radio Base Station

205, 401, 701: CQI Reception Timing Controller

25 207: Buffer

208: Decoder

220: CQI Reception Timing Priority Determiner

2003-284512

69

SF#0 to SF#7: Sub-frame

300: Higher Apparatus

2003-284512

70

[NAME OF DOCUMENT] ABSTRACT

[Abstract]

[Object] An object is to prevent deterioration in CQI error rate characteristics even when CQI update cycle information and CQI repetition count information are configured such that a transmission or reception timing of a CQI that is based on the CQI update cycle information and a transmission or reception timing of a CQI that is based on the CQI repetition count information overlap.

10 [Overcoming Means] When a transmission timing of a CQI that is based on predetermined CQI update cycle information and a transmission timing of a CQI that is based on CQI repetition count information overlap, CQI transmission timing controller 110 and CQI transmission timing priority determiner 120 transmit CQI based on the  
15 repletion count information with priority. As a result, it is possible to secure the number of combinations of CQIs at a receiving side and prevent deterioration in CQI error rate characteristics.

20 [Selected Drawing] FIG. 1



2003-284512

71

## FIG. 1

100: COMMUNICATION TERMINAL  
102: ANTENNA DUPLEXER  
103: RADIO RECEIVER  
5 104: DESPREADER  
105: DEMODULATOR  
106: DECODER  
107: SIR MEASURER  
108: CQI CALCULATOR  
10 109: TRANSMIT FRAME GENERATOR  
110: CQI TRANSMISSION TIMING CONTROLLER  
111: MODULATOR  
112: SPREADER  
113: RADIO TRANSMITTER  
15 120: CQI TRANSMISSION TIMING PRIORITY DETERMINER  
121: MEMORY  
TRANSMIT DATA  
CQI UPDATE CYCLE  
CQI REPETITION COUNT  
20 RECEIVE DATA

## FIG. 2

200: RADIO BASE STATION  
202: ANTENNA DUPLEXER  
25 203: RADIO RECEIVER  
204: DESPREADER  
205: CQI RECEPTION TIMING CONTRLLER

2003-284512

72

206: DEMODULATOR

207: BUFFER

208: DECODER

209: SCHEDULER

5 210: TRANSMIT FRAME CONTROLLER

211: MODULATOR

212: SPREADER

213: RADIO TRANSMITTER

220: CQI RECEPTION TIMING PRIORITY DETERMINER

10 221: MEMORY

TRANSMIT DATA

RECEIVE DATA

CQI UPDATE CYCLE

CQI REPETITION COUNT

15

FIG. 3

CQI MEASUREMENT PERIOD

FIG. 5

20 CQI MEASUREMENT PERIOD

UE TRANSMISSION

BTS RECEPTION

CQI 1 IS ACTUALLY RECEIVED

NO SIGNAL IS ACTUALLY RECEIVED

25 CQI 3 IS ACTUALLY RECEIVED

FIG. 6

2003-284512

73

CQI MEASUREMENT PERIOD

UE TRANSMISSION

BTS RECEPTION

CQI 2 IS ACTUALLY RECEIVED

5 CQI 2 IS ACTUALLY RECEIVED

CQI 4 IS ACTUALLY RECEIVED

FIG. 7

CQI MEASUREMENT PERIOD

10 UE TRANSMISSION

BTS RECEPTION

FIG. 8

300: HIGHER APPARATUS

15 400: RADIO BASE STATION

500: COMMUNICATION TERMINAL

FIG. 9

500: COMMUNICATION TERMINAL

20 102: ANTENNA DUPLEXER

103: RADIO RECEIVER

104: DESPREADER

105: DEMODULATOR

106: DECODER

25 107: SIR MEASURER

108: CQI CALCULATOR

109: TRANSMIT FRAME GENERATOR

110: CQI TRANSMISSION TIMING CONTROLLER  
111: MODULATOR  
112: SPREADER  
113: RADIO TRANSMITTER  
5 120: CQI TRANSMISSION TIMING PRIORITY DETERMINER  
121: MEMORY  
501: CQI TRANSMISSION TIMING CONTROLLER

## TRANSMIT DATA

10 CQI UPDATE CYCLE  
CQI REPETITION COUNT  
RECEIVE DATA  
NEW CQI UPDATE CYCLE  
NEW CQI REPETITION COUNT

15

## FIG. 10

400: RADIO BASE STATION  
202: ANTENNA DUPLEXER  
203: RADIO RECEIVER  
20 204: DESPREADER  
205: CQI RECEPTION TIMING CONTRLLER  
206: DEMODULATOR  
207: BUFFER  
208: DECODER  
25 209: SCHEDULER  
210: TRANSMIT FRAME CONTROLLER  
211: MODULATOR

2003-284512

75

212: SPREADER

213: RADIO TRANSMITTER

220: CQI RECEPTION TIMING PRIORITY DETERMINER

221: MEMORY

5 300: HIGHER APPARATUS

401: CQI RECEPTION TIMING CONTROLLER

TRANSMIT DATA

RECEIVE DATA

CQI UPDATE CYCLE

10 CQI REPETITION COUNT

NEW CQI UPDATE CYCLE

NEW CQI REPETITION COUNT

ERROR SIGNAL

15 FIG. 11

600: COMMUNICATION TERMINAL

102: ANTENNA DUPLEXER

103: RADIO RECEIVER

104: DESPREADER

20 105: DEMODULATOR

106: DECODER

107: SIR MEASURER

108: CQI CALCULATOR

109: TRANSMIT FRAME GENERATOR

25 110: CQI TRANSMISSION TIMING CONTROLLER

111: MODULATOR

112: SPREADER

2003-284512

76

113: RADIO TRANSMITTER

120: CQI TRANSMISSION TIMING PRIORITY DETERMINER

121: MEMORY

601: CQI TRANSMISSION TIMING CONTROLLER

5

TRANSMIT DATA

CQI UPDATE CYCLE

CQI REPETITION COUNT

RECEIVE DATA

10 NEW CQI UPDATE CYCLE

NEW CQI REPETITION COUNT

FIG. 12

700: RADIO BASE STATION

15 202: ANTENNA DUPLEXER

203: RADIO RECEIVER

204: DESPREADER

205: CQI RECEPTION TIMING CONTRLLER

206: DEMODULATOR

20 207: BUFFER

208: DECODER

209: SCHEDULER

210: TRANSMIT FRAME CONTROLLER

211: MODULATOR

25 212: SPREADER

213: RADIO TRANSMITTER

220: CQI RECEPTION TIMING PRIORITY DETERMINER

2003-284512

77

221: MEMORY

300: HIGHER APPARATUS

701: CQI RECEPTION TIMING CONTROLLER

TRANSMIT DATA

5 RECEIVE DATA

CQI UPDATE CYCLE

CQI REPETITION COUNT

NEW CQI UPDATE CYCLE

NEW CQI REPETITION COUNT

10

FIG. 13

10: COMMUNICATION TERMINAL

12: ANTENNA DUPLEXER

13: RADIO RECEIVER

15 14: DESPREADER

15: DEMODULATOR

16: DECODER

17: SIR MEASURER

18: CQI CALCULATOR

20 19: TRANSMIT FRAME GENERATOR

20: CQI TRANSMISSION TIMING CONTROLLER

21: MODULATOR

22: SPREADER

23: RADIO TRANSMITTER

25 24: MEMORY

TRANSMIT DATA

CQI UPDATE CYCLE

2003-284512

78

CQI REPETITION COUNT  
RECEIVE DATA

FIG. 14

5 CQI MEASUREMENT PERIOD

FIG. 15

30: RADIO BASE STATION  
32: ANTENNA DUPLEXER  
10 33: RADIO RECEIVER  
34: DESPREADER  
35: CQI RECEPTION TIMING CONTRLLER  
36: DEMODULATOR  
37: BUFFER  
15 38: DECODER  
39: SCHEDULER  
40: TRANSMIT FRAME CONTROLLER  
41: MODULATOR  
42: SPREADER  
20 43: RADIO TRANSMITTER  
44: MEMORY  
TRANSMIT DATA  
RECEIVE DATA  
CQI UPDATE CYCLE  
25 CQI REPETITION COUNT

FIG. 17



2003-284512

79

CQI MEASUREMENT PERIOD

IS CQI 2 TRANSMITTED?

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